Could hydrogen storage be part of NZ's 100% renewable electricity system? Q&A on new Energy Link report

Using green hydrogen, could New Zealand store excess renewable energy for when it's needed most? A new independent Energy Link report, commissioned by Clarus, found that hydrogen storage "would be a strong performer in terms of delivering benefits" and is one of the best solutions to fully decarbonise New Zealand's electricity system and stop market volatility. It had the lowest overall cost to consumers compared to the existing proposed solutions of overbuilding renewables or using Lake Onslow to store hydroelectricity.

It's a complex topic, and we've had plenty of questions since the report was released in early December. Here we're answering some of those questions and explaining a bit more about how hydrogen storage could support a net carbon zero future for Aotearoa.

Why hydrogen is safe
Hydrogen has been safely stored, transported and used across industries over many decades. Just like natural gas, LPG and petrol, hydrogen safety is about understanding how the gas behaves and how to handle it.

The good news is hydrogen has been well studied and there is already significant evidence on safe handling. Let's take a closer look at this.

The safe handling of hydrogen:

- Because it's much lighter than air, hydrogen dissipates quickly when released, allowing for relatively rapid dispersion of the fuel in case of a leak, which reduces the risk of ignition or fire. Hydrogen is also non-toxic.
- Research indicates that hydrogen leaks at the same rate as natural gas and it's important to have appropriate safety procedures and sensitive leak detection systems, which are already in place to detect natural gas leaks today.
- Hydrogen is a very small molecule and at very high pressures can cause embrittlement of some metals, so storage equipment needs to be appropriately designed for the safe use of the gas.

Gas networks have been running safely in New Zealand for almost 50 years. **Clarus** reliably transports natural gas across the North Island every day and we are confident we can adapt to the safety requirements of hydrogen gas in the future.

If this report is commissioned by Clarus, how can it be independent?
Although Clarus commissioned this analysis we didn't influence the analysis or conclusions. We conducted the study because we wanted to understand if a hydrogen storage solution had merits, versus other proposed solutions to enable reaching a fully renewable electricity system and, although we knew there would be some merits, we didn't expect the results to be as positive as they were.

We would love to see more work conducted on hydrogen storage and strategies to reach net zero by 2050. Hopefully other organisations and the Government will put further funding behind this so we can work out the best ways to decarbonise Aotearoa's energy supply. A lot of further work in this space is also happening overseas which we can learn from. Our research is only one piece of data in what we hope will be a wealth of further work to inform everyone's decision-making.

Can't we just electrify everything?
There are two reasons that hydrogen storage could help New Zealand transition away from fossil fuels. First, not everything can be electrified. Some applications simply don't electrify easily – think about shipping vessels, aviation, and many industrial processes. Hydrogen is a viable alternative for some of those hard-to-decarbonise sectors.

But this report was actually about how we can support the decarbonisation of those things that we can electrify. As electricity demand increases and the system becomes more renewable with more dependence on intermittent renewables like solar and wind, we'll need a way of storing energy for when the wind isn't blowing and the sun isn't shining. Right now we rely on burning coal to back up the electricity system. This report considers whether green hydrogen could be a viable way to store excess renewable power until we need it.

Shouldn't we invest more in hydro power instead of hydrogen?
Here in Aotearoa we are great at producing hydro power, with more than 100 hydroelectric plants. It's a fantastic zero-carbon source of energy that provides more than half of our total electricity production.

The problem with hydro power is that the weather is unreliable. When rainfall is low, as it was in 2021 and early 2022, the dams get too low and enough power cannot be generated. At that point we need to fall back on burning coal at the Huntly Power station. Furthermore, electricity demand is expected to grow, but it isn't easy to build new large-scale hydro dams. This report is about whether hydrogen can be useful in those dry years, to bridge the gap between power use and other types of renewable power.

The report explains that the appeal of hydrogen storage scenarios is the possibility that it could "replace the existing thermal fleet [coal plant] and natural gas storage in the North Island, and potentially reduce the need for large-scale demand-response by consumers."

Why does hydrogen have a bad reputation for carbon emissions?
The majority of hydrogen produced worldwide is made using processes that generate emissions. This hydrogen, (sometimes referred to as 'grey', 'brown' or 'black' hydrogen) is an overall contributor of carbon dioxide into the atmosphere. As a result, hydrogen is viewed with some scepticism as a pathway for decarbonisation.

However, in New Zealand we can produce 'green' hydrogen from renewable power, with no emissions.